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IN THE UNITED STATES DISTRICT COURT
FOR THE DISTRICT OF HAWAII

LUIS SANCHO, WALTER L.
WAGNER,

Plaintiffs,

vs.

UNITED STATES DEPARTMENT OF
ENERGY, et al.,

Defendants.

CIVIL NO. 08-00136-HG-KSC

**AMENDED BRIEF *AMICUS CURIAE*
OF SHELDON GLASHOW, FRANK
WILCZEK AND RICHARD WILSON
IN SUPPORT OF FEDERAL
DEFENDANTS; CERTIFICATE OF
SERVICE**

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SHELDON GLASHOW, FRANK WILCZEK AND RICHARD WILSON
IN SUPPORT OF FEDERAL DEFENDANTS**

PRELIMINARY STATEMENT and INTEREST OF AMICI

Amici are physicists who have specialized in nuclear particle physics for most of their distinguished careers. Two of them have been awarded the Nobel Prize in Physics for their contributions to the understanding of elementary atomic and sub-atomic particles; the third holds and has held endowed chairs in physics at Harvard University, was chairman and is currently a member of the Harvard Cyclotron Operating Committee, and is an expert in, and has published extensively on, the subjects of high energy physics, radiation physics, nuclear safety and risk analysis.

Amici have special knowledge which they believe will assist the Court in this case. Similar claims of potentially cataclysmic disasters were made (including by one of the plaintiffs in this case) when the Relativistic Heavy Ion Collider (RHIC) was planned, constructed, and began operation at Brookhaven National Laboratory on Long Island, New York State. One of the *amici* was a member of the high level committee selected to analyze the potential risks of the RHIC, and the other two *amici* published an article on the risks associated with the RHIC in *Nature*, one of the most prestigious scientific journals, prior to the commencement of operations of the RHIC. In fact, the RHIC has been fully operational for almost ten years without incident.

Amici are concerned about the use of litigation that is based on misinformation and misunderstanding of science under the guise of concern for the environment that inhibits vital and important scientific inquiry.

This case involves challenges to the United States' financial support for the construction of the Large Hadron Collider ("LHC"), a subatomic particle accelerator straddling the French-Swiss border near Geneva, Switzerland, and research to be conducted there. The core of Plaintiffs' complaint alleges that the United States and other defendants violated the National Environmental Policy Act ("NEPA") by failing to prepare an adequate analysis of the risks of several theoretical objects that Plaintiffs allege could be produced by the Collider.

Amici submit this brief in support of the federal Defendants' argument that Plaintiffs' allegations of injury are speculative and are not scientifically credible because they are based on purely hypothetical occurrences which do not pose a safety risk.

Amici are aware that the LHC has undergone thorough scientific safety and risk analyses, and are familiar with the numerous scientific papers examining the risks associated with the LHC. These scientific papers have examined, *inter alia*, the very claims asserted by Plaintiffs here. Plaintiffs' claims have not been accepted by the scientific community and are not based on rigorous scientific analysis. Other than the purely speculative "disaster" Plaintiffs recite in the

Complaint, they do not allege any injury that is particularized, nor do they assert any claim with sufficient geographical nexus to the United States.¹

ARGUMENT

PLAINTIFFS' ALLEGATIONS OF A SAFETY RISK AT CERN AND INJURY TO THEM ARE PURELY HYPOTHETICAL, SPECULATIVE, AND NOT CREDIBLE

Defendants United States Department of Energy ("DOE") and the National Science Foundation ("NSF") (the "federal Defendants") have moved to dismiss Plaintiffs' claims for lack of subject matter jurisdiction and have also moved for summary judgment on the grounds that Plaintiffs' claims against the construction of the LHC are time barred. The federal Defendants assert, *inter alia*, that the Plaintiffs do not have standing because the alleged injury to them is speculative and not credible.^{2, 3}

¹ The LHC is operated by the European Organization for Nuclear Research ("CERN"), an intergovernmental organization. The LHC is located and will operate completely outside the territory of the United States. The United States is not a member of CERN.

² The federal Defendants' motion to dismiss under Fed.R.Civ.P. 12(b)(6), based on standing, may be considered a motion under Fed.R.Civ.P. 56, because it is supported by declarations and other matter outside the complaint. For the reasons explained below, we submit that Plaintiffs cannot meet their burden under Fed.R.Civ.P. 56.

³ A party seeking summary judgment bears the initial burden of informing the court of the basis for its motion and of identifying those portions of the pleadings and discovery responses that demonstrate the absence of a genuine issue of material fact. *See Celotex Corp. v. Catrett*, 477 U.S. 317, 323, 106 S.Ct. 2548, 91 L.Ed.2d 265 (1986). Where the moving party will have the burden of proof on an issue at trial, the movant must affirmatively demonstrate that no reasonable trier of fact could find other than for the moving party. On an issue as to which the nonmoving party will have the burden of proof, however, the movant can prevail merely by pointing out that there is an absence
(continued...)

Amici argue that the complaint and affidavits filed by the Plaintiffs in this case are without merit.

Scientists who have proposed the construction and operation of the particle collider known as Large Hadron Collider (“LHC”) at CERN are aware of problems associated with quantitatively assessing the risks involved with this novel project. This is not a new problem and virtually every new significant activity must face it. Instead of ending the pursuit of significant scientific endeavors, the scientific community has developed processes to identify all imaginable events that may lead to an adverse effects and use the best available

³(...continued)

of evidence to support the nonmoving party's case. *Id.* If the moving party meets its initial burden, the non-moving party must set forth, by affidavit or as otherwise provided in Rule 56, “specific facts showing that there is a genuine issue for trial.” *Anderson v. Liberty Lobby, Inc.*, 477 U.S. 242, 250, 106 S.Ct. 2505, 91 L.Ed.2d 202 (1986); Fed.R.Civ.Proc. 56(e). The non-movant must come forward with “specific facts” showing a genuine factual issue for trial. Fed.R.Civ.P. 56; *Celotex Corp. v. Catrett*, 477 U.S. 317, 325, 106 S.Ct. 2548, 91 L.Ed.2d 265 (1986); *Matsushita Elec. Indus. Co. v. Zenith Radio Corp.*, 475 U.S. 574, 587, 106 S.Ct. 1348, 89 L.Ed.2d 538 (1986). *Amici* respectfully submit that Plaintiffs here cannot do this. Conclusory, speculative testimony in affidavits and moving papers is insufficient to raise genuine issues of fact and defeat summary judgment. See *Nelson v. Pima Community College*, 83 F.3d 1075, 1081-82 (9th Cir.1996) (“[M]ere allegation and speculation do not create a factual dispute for purposes of summary judgment.”); *Thornhill Pub. Co., Inc. v. GTE Corp.*, 594 F.2d 730, 738 (9th Cir.1979). See *Soremekun v. Thrifty Payless, Inc.*, Case No. CV 04-06868 MMM (C.D. Cal.), *aff’d Soremekun v. Thrifty Payless, Inc.*, 509 F.3d 978, (9th Cir. 2007); *Nissan Fire & Marine Insurance Company, Ltd v. Fritz Companies, Inc.*, 210 F.3d 1099, 1103-1106 (9th Cir. 2000). A mere scintilla of evidence is insufficient to defeat summary judgment. *Anderson v. Liberty Lobby, Inc.*, 477 U.S. 242, 248-49, 106 S.Ct. 2505, 91 L.Ed.2d 202 (1986) (quoting *First Nat’l Bank v. Cities Serv. Co.*, 391 U.S. 253, 288-89, 88 S.Ct. 1575, 20 L.Ed.2d 569 (1968)). *Amici* submit that, based on scientific principles explained in the risk analyses of the LHC, Plaintiffs cannot meet their burden under Fed.R.Civ.P. 56. Any evidence they might proffer would, we submit, be inadmissible under the tests set forth by the Supreme Court in *Daubert v. Merrill Dow Pharmaceuticals*, 509 U.S. 579 (1993) and *General Electric Co. v. Joiner*, 522 U.S. 136 (1997).

information and scientific talent to mitigate them. No other procedure has been suggested by any professional society, any government or international organization. *Amici* contend that the Plaintiffs' suppositions are without merit, and cannot be the basis of a particularized injury sufficient to confer standing.

Until half a century ago industrial safety was managed by learning from past mishaps and by using appropriate measures to avoid their recurrence. For example, miners once used caged canaries as methane detectors. This management process is no longer acceptable as modern technologies have sometimes led to disasters, such as Union Carbide in Bhopal, India, so large and severe that people demand proof-in-principle that they cannot happen. Society wants to avoid failures at nuclear power reactors and chemical plants. So the old protocol for risk avoidance- try it once; if it turns out to be dangerous, modify the technology, or don't do it again-is no longer acceptable.

In the case before this Court, one important questions is whether the LHC at CERN is sufficiently understood that we can be confident that it will not cause a catastrophe of cosmic dimensions, as Plaintiffs claim. *Amici* assert that the question has been asked and studied by many of the world's best scientists and they have concluded that not only has a scientifically acceptable procedure been followed but that we *do* know enough to respond to the safety requirements.

During the early 1970s a process was developed to assess the safety of new technologies such as nuclear electric power plants, large oil refineries, large chemical plants, liquefied natural gas facilities, and other large and technically complex facilities. That process consists of a group of qualified individuals first imagining the worst types of catastrophic failures that could occur at the facility, and then designing a system to reduce the probability of such failure occurring and reducing the consequences of a failure to an acceptable level. This process (often called “fault tree analysis” or “FTA” or “event tree analysis” or “ETA”) has been adopted by the nuclear⁴, chemical, and oil industries and by government agencies such as the Nuclear Regulatory Commission and NASA⁵.

The *amici* recognize that a new procedure had to be developed for the concerns at issue in this case. It has been claimed that the new particle accelerator could trigger an irreversible process that would have enormous consequences including the destruction of the Earth. This is not a new concern – for example, scientists working on the Manhattan Project in the 1940s seriously considered

⁴ The Electric Power Research Institute's (EPRI) CAFTA software, which is used by many of the U.S. nuclear power plants and by a majority of U.S. and international aerospace manufacturers, and the U.S. Government to evaluate the safety and reliability of nuclear reactors, the Space Shuttle, and the International Space Station is an example.

⁵ See U.S. Nuclear Regulatory Commission Fault Tree Handbook (NUREG-0492), <http://www.nrc.gov/reading-rm/doc-collections/nuregs/staff/sr0492/>, last accessed 08/07/08; NASA, Fault Tree Handbook with Aerospace Applications (2002), <http://www.hq.nasa.gov/office/codeq/doctree/fthb.pdf>, last accessed 08/07/08.

whether a nuclear explosion could release enough energy to ignite the Earth's atmosphere. At that time, probabilistic risk assessment, as it is known today, did not yet exist. The Manhattan Project scientists used then existing knowledge and concluded that the catastrophe postulated would not happen, and history has proven them right.

Concerns about the LHC at CERN are legitimate and are properly raised. In fact, they have been raised, studied, and answered decisively by scientists in the United States and in Europe. But the revival of the concern by the Plaintiffs in this case is not well-founded, or even legitimate, because they have, apparently, not educated themselves about the extensive analysis that has been done and the published literature widely available on the subject.

This is not the first such new particle accelerator, or the first such study of risks, or the first reassurance of the safety of a powerful particle accelerator. The closest analogy is the Relativistic Heavy Ion Collider (RHIC) at Brookhaven National Laboratory on Long Island in , New York State, where beams of highly charged gold or lead atoms (the heavy ions) traveling at “relativistic speeds” (approaching the speed of light – 99.95% of light speed) sped in opposite directions around circular racetracks before colliding. RHIC truly is an atom smasher: it creates nucleus-to-nucleus impacts, taking place thousands of times per second, each impact producing thousands of secondary particles. These

incredibly complex “events” are recorded by sophisticated detectors and analyzed by supercomputers and a world-wide network of smaller computers. The Brookhaven RHIC studies matter at densities and temperatures never seen before in the laboratory; on a small scale, it reproduces the extreme conditions that existed in the early universe, conditions under which the constituents of ordinary matter are expected to be liberated as quark-gluon plasma. Physicists had long speculated about this state of matter, but RHIC allowed them to glimpse it. About nine years ago a doomsday vision similar to the one put forward by Plaintiffs here was advanced relating to the RHIC.⁶

One of the *amici*, Frank Wilczek, in the July 2000 issue of *Scientific American*⁷ described the concern. The procedure that was followed was important and a good example for the future. The director of Brookhaven National Laboratory established a blue ribbon panel of independent experts (including

⁶ One of the Plaintiffs in this case, Walter L. Wagner, brought suits in 1999 and 2000 in the Northern District of California and in the Eastern District of New York to enjoin operation of the RHIC at the Brookhaven National Laboratory. *Wagner v. U.S. Dep't of Energy*, Case No. C99-2226 MMC (N.D. Cal. May 14, 1999) and *Wagner v. Brookhaven Science Associates, LLC.*, Civ. No. 00-1656 (S.D.N.Y. March 3, 2000). Both lawsuits were dismissed (*See* Exs. J, items 66 and 67 (N.D. Cal. Docket Sheet) and H (E.D.N.Y. Order, 5/26/2000) annexed to the federal Defendants' motion). In neither of these cases did the courts give any credence to Wagner's theories about the types of dangerous effects that Plaintiffs here claim would result from subatomic particle collisions. This Court should reject Plaintiffs' similar challenges in this case and dismiss their claims.

⁷ Wilczek, F., Letter to the Editor on the Relativistic Heavy Ion Collider (RHIC) at Brookhaven National Laboratory, 281 *Scientific American* (July 8, 1999). Prof. Wilczek's letter was a reply to Walter L. Wagner's letter "Black holes at Brookhaven?" which appeared in the same issue of *Scientific American*.

Wilczek himself) to investigate the subject. The most creative scientists were tasked to imagine what might go wrong and satisfy themselves that the imagined problems did not exist. They examined carefully three scientifically conceivable disaster scenarios in which experiments might produce “black holes” that could gradually consume the Earth; or could create a “vacuum instability” that could expand catastrophically in all directions at the speed of light; or might produce “strangelets,” a kind of “strange matter” that would grow to incorporate ordinary matter, perhaps transforming the entire Earth into its form. The first two issues have been raised, and dismissed, each time a new particle accelerator opens. Using similar arguments, Jaffe, *et al.* were able to conclude that neither posed any threat at RHIC.⁸ There is no chance at all that RHIC could manufacture a black hole or gravitational singularity. Even if RHIC (or its higher energy successors) could create a black hole, such a black hole would be so tiny it would evaporate instantly.^{9, 10}

In the natural world, relativistic heavy ions in the form of cosmic rays have

⁸ Jaffe, R. L., Busza, W., Wilczek, F., and Sandweiss, J., Review of Speculative 'Disaster Scenarios' at RHIC, 72 *Rev. Mod. Phys.* 1125-1040 (2000).

⁹ See Blaizot, J.-P., Iliopoulos, J., Madsen, J., Ross, G.G., Sonderegger, P., and Specht, H.-J., Study of Potentially Dangerous Events During Heavy-ion Collisions at the LHC: Report of the LHC Safety Study Group. Report CERN 2003-001 (CERN 2003)

¹⁰ Previous studies also argued against a vacuum instability, but could not quite rule it out.

been in RHIC-like collisions with one another in space for eons (more, in fact, than will ever take place at RHIC). These distant collisions do not make RHIC experimentally less useful, because (unlike at RHIC) they cannot be directly studied, but one fact is clear: cosmic ray collisions in space have not led to the creation of a new vacuum, so we breathe easily. The third concern arose from the fact that RHIC accelerates heavy ions rather than individual elementary particles, and must be considered more carefully. Such careful consideration was given in studies by Jaffe, *et al.* and by Dar, *et al.*¹¹ Both groups included theorists who were among the first to speculate that lumps of strange matter called strangelets, which contain many strange quarks as well as the usual up and down quarks that make up atomic nuclei, might be more stable than ordinary matter. The strangelet disaster scenario described by Glashow and Wilson¹² would only be credible if strangelets exist (which is conceivable), and if they form reasonably stable lumps (which is unlikely), and if they are negatively charged (unlikely given that current theory strongly favors positive charges), and if tiny strangelets can be created at RHIC (which was and is exceedingly unlikely); in fact it has not occurred in the

¹¹ Dar, A., De Rujula, A., and Heinz, U., Will Relativistic Heavy-ion Colliders Destroy Our Planet? 470 *Phys. Lett. B* 142-148 (1999).

¹² Glashow, S.L.: and Wilson, R., Taking Serious Risks Seriously, 402 *Nature* 596-597 (1999).

several years that RHIC has been operational.^{13, 14} The RHIC was approved, and it has run successfully, with no sign whatever of the problems described above.

Plaintiffs allege that by causing the collision of subatomic particles, the LHC could create dangerous objects that they describe as “strangelets,” “micro black holes,” and “magnetic monopoles” that allegedly might destroy the planet. The LHC is in many ways very much simpler than the RHIC. The LHC primarily accelerates and causes the collision of elementary particles -- protons. Only a small proportion of its use involves collision of nuclei. Although the LHC operates at a much higher energy level than the RHIC, the likelihood of any of the postulated catastrophes envisaged by the most imaginative physicists is likely to be no greater than with a nuclear collider.¹⁵

The CERN management followed the example set by Brookhaven National Laboratory and commissioned a high level independent committee (the LHC Safety Study Group or LSSG) to imagine what could go wrong. This committee

¹³ The RHIC White Papers, 757 *Nucl. Phys. A* 1 (2005).

¹⁴ Blaizot, J.-P, Iliopoulos, J., Madsen, J., Ross, G.G., Sonderegger, P., and Specht, H.-J., Study of Potentially Dangerous Events During Heavy-ion Collisions at the LHC: Report of the LHC Safety Study Group. Report CERN 2003-001 (CERN 2003).

¹⁵ One of the affidavits submitted by Plaintiffs concedes that it is “quite possible” that the LHC might operate without harm. Aff. of Mark Leggett (“Leggett Aff.”), ¶ 7.

reported its conclusions in 2003.¹⁶ It found that the likelihood of the kinds of events postulated by the Plaintiffs to be insignificant. In particular, the probability that “strangelets” exist at LHC is even smaller than at RHIC, and, as noted above, there are no signs whatever that “strangelets” have been created at RHIC. Their work was reviewed by the LHC Safety Assessment Group (or LSAG), which very recently studied actual operations of the LHC and confirmed that no such events have in fact occurred.¹⁷

An even more recent paper by Koch, B., Bleicher, M., and Stocker, H., Exclusion of Black Hole Disaster Scenarios at the LHC, arXiv:0807.3349v [hep-ph] (unpublished, July 22, 2008)(available at <http://arxiv.org/abs/0807.3349v1>, last accessed 08-08-08) addresses “fear in the public, that the conjectured production of mini black holes might lead to a dangerous chain reaction” and “summarize[s] the most straight forward proofs that are necessary to rule out such doomsday scenarios.” The authors conclude that “none of the physically sensible

¹⁶ Blaizot, J.-P., Iliopoulos, J., Madsen, J., Ross, G.G., Sonderegger, P., and Specht, H.-J., Study of Potentially Dangerous Events During Heavy-ion Collisions at the LHC: Report of the LHC Safety Study Group. Report CERN 2003-001 (CERN 2003).

¹⁷ Ellis, J., Giudice, G., Mangano, M., Tkachev, I., and Wiedemann, U., “Review of the Safety of LHC Collisions” <http://lsag.web.cern.ch/lsag/LSAG-Report.pdf>, last accessed 08/08/08 (also Attachment 15 to the Declaration of Bruce Strauss, June 23, 2008, attached to federal Defendants’ motion) and CERN Scientific Policy Committee, “SPC Report on LSAG Documents” <http://indico.cern.ch/getFile.py/access?contribId=20&resId=0&materialId=0&confId=35065>, last accessed 08/08/08 (also Attachment 16 to the Declaration of Bruce Strauss, June 23, 2008, attached to federal Defendants’ motion).

paths . . . can lead to a black hole disaster at the LHC.” *Id.* at 7.

CONCLUSION

Amici consider that the operation of the LHC is safe, not only in the old sense of that word, but in the more general sense that our most qualified scientists have thoroughly considered and analyzed the risks involved in the operation of the LHC. Plaintiffs’ claims are merely hypothetical and speculative, and contradicted by much evidence and scientific analysis and the complaint should be dismissed.

DATED: Honolulu, Hawaii, September 29, 2008.

/S/ Robert M. Kohn
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BIOGRAPHICAL ADDENDUM

SHELDON LEE GLASHOW is a Nobel Laureate in Physics. He is Arthur G.B. Metcalf Professor of Physics at Boston University. Previously he was the Higgins Professor of Physics and Mellon Professor of the Sciences at Harvard University, and. He is a fellow of the American Physical Society and the American Association for the Advancement of Science; member of the American Academy of Arts and Sciences, the National Academy of Sciences, and the American Philosophical Society; foreign member of the Russian and Korean Academies of Science; and founding editor of Quantum Magazine. He is the recipient of many awards, including the Oppenheimer Medal, the Richtmyer Lecture Award, and the Erice Science for Peace Prize.

FRANK WILCZEK is a theoretical physicist and Nobel Laureate in Physics. He is currently the Herman Feshbach Professor of Physics at the Massachusetts Institute of Technology. Wilczek along with H. David Politzer and David Gross were awarded the Nobel Prize in Physics in 2004 for their discovery of asymptotic freedom in the theory of the strong interaction. His current research interests include "pure" particle physics: connections between theoretical ideas and observable phenomena, quantum theory of black holes, behavior of matter – the phase structure of quark matter at ultra-high temperature and density; “color” superconductivity, the application of particle physics to cosmology, and the application of field theory techniques to condensed matter physics.

RICHARD WILSON is Mallinckrodt Research Professor of Physics at Harvard University and immediate past Director of the Regional Center for Global Environmental Change at Harvard University. Professor Wilson is a past Chairman of the Department of Physics at Harvard University, a past chairman and currently a member of the Cyclotron Operating Committee. He is an Affiliate of the Center for Science and International Affairs and the Center for Middle Eastern Studies at Harvard University. He is a founder of the Society for Risk Analysis. He is and has been a consultant to the United States government and the governments of numerous foreign countries on matters of nuclear safety, toxicology, epidemiology, public health and safety, and risk assessment. Professor Wilson’s areas of expertise include elementary particle physics, radiation physics, chemical carcinogens, air pollution, ground water pollution by arsenic, and human rights. He is the author of many articles on high energy physics, environmental pollution and risk analysis, including PARTICLES IN OUR AIR, EXPOSURES AND

HEALTH EFFECTS (with Editor John Daniel Spengler) (Harvard University Center for Risk Analysis, 1986) and RISK-BENEFIT ANALYSIS (with Edmund A. C. Crouch) (Harvard University Center for Risk Analysis, 2nd ed. 2001). Professor Wilson is the author or co-author of more than 880 published papers on subjects including atomic particles, radioactive particle decay, shielding of particle accelerators and nuclear reactors, nuclear energy production, health risks of nuclear power plant accidents, risks and health impacts of radiation, risks of nuclear proliferation, health effects of electromagnetic fields, acute toxicity and carcinogenic risk, carcinogenicity bioassays, statistical distributions of health risks, public health, cancer risk management, risk benefit analysis, and global energy use and global warming.